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Mantle Isotopic Components in The Back-Arc Side of The Ryukyu Arc

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Eurasian plate with its central part being a locus of active Ryukyu arc volcanism associated with subduction of the Philippine Sea plate. Related to the subduction and lithospheric dislocation caused by Eurasian plate dynamics, a number of northeast-southwest direction back-arc rifts including the nascent Okinawa Trough are formed in the East China Sea, west of the island. Northern Kyushu Cenozoic intraplate volcanism, that is not associated with the subduction, occurs over a vast area, producing mainly (oceanic island basalt) OIB-like sub-alkali to alkali basalts, in some case, accompanied by calc-alkaline andesite to rhyolite. Isotopic compositions of basalts from different centers, while reflecting a minor effect by eruption age, plot within distinct fields and show a broad correlation between enriched mantle type 1 (EM1) and type 2 (EM2), with $^{206}Pb/^{204}Pb$, respectively, = 17.80 and 18.40, $^{87}Sr/^{86}Sr$ = 0.7043 and 0.7052, Δ8/4Pb = 115 and 60. Beside the difference in isotopic compositions, the EM1- and EM2-like are also distinct in trace element characteristics. The Kyushu data plotted together with those from the Sea of Japan reveal a three-component correlation, in that, (A) defined by EM1-like basalts with low $^{206}Pb/^{204}Pb$ (17.8), average $^{87}Sr/^{86}Sr$ (< 0.7045) and high Δ8/4Pb (>110); (B) defined by the most EM2-rich samples with high $^{87}Sr/^{86}Sr$ (> 0.705), $^{206}Pb/^{204}Pb$ (18.4) and low Δ8/4Pb (65); and (C) represented by basalts from the Okinawa Trough with high $^{206}Pb/^{204}Pb$ (> 18.3), low $^{87}Sr/^{86}Sr$ (< 0.704) and Δ8/4Pb (50), and N-MORB-like trace element patterns with slightly negative anomalies at Nb and Ta. Based on the fact that, chemical compositions of basalts at each center are relatively homogeneous, however, different from center to center, suggesting spatial factor is important. We propose that, while the mantle beneath northern Kyushu is very much similar to that of the Sea of Japan, represented by a spectrum of depleted MORB-EM1 hybrids believed to present throughout the East Asian asthenosphere, EM1-like (A) and EM2-like (B) may be acquired from shallower levels, possibly in the lithosphere mantle. Regarding C (Okinawa Trough) component, because of the depleted nature of its trace element patterns in addition to relative depletion in Sr-Nd isotopic systematics, it may represent N-MORB-like melts modified by subduction-related fluid.

Keywords: Ruykyu Arc, Okinawa Trough, Kyushu, volcanism, isotope